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## Business Africa

*Solar Solutions for Remote Regions*

July 1998



NASA Langley EOSDIS Distributed Active Archive Center

According to U.S. Senator Richard Lugar, U.S. policy towards sub-Saharan Africa is being revised to reflect changing global and regional realities for economic development, political stability, or self-reliance. The African Growth and Opportunity Act has passed the House. There are 11 sponsors of the bill in the Senate. The African Growth and Opportunity Act is the first serious attempt to provide a general road map for expanding economic engagement and involvement in Africa through enhanced trade and investment. It seeks to establish a more mature partnership with those countries in Africa undertaking serious economic and political reforms. Virtually all African Ambassadors have endorsed this bill. It has wide support in the American business community, non-government organizations, the African-American community, and the Administration. The NASA Langley DAAC participated in an international trade initiative sponsored by the State of Indiana, the Department of Commerce, and the U.S. Small Business Administration. Entitled "Business Africa," the goal was to begin satisfying the objectives of the African Growth and Opportunity Act.

The Langley DAAC exhibit, "Solar Solutions for Remote Regions" used the Surface Solar Energy (SSE) data set archived at the DAAC to illustrate the feasibility of solar collections in remote regions. This satellite-derived data set is formulated for the Renewable Energy Industry for the application of solar energy technologies and is very useful in a wide range of energy technologies and agricultural applications. The exhibit displayed Java-enabled animated images of the SSE data for Average Total Horizontal-Surface Down (average total energy) and Average Daylight Cloud Fraction during the time period April 1985 to December 1988.

(view animations for [Average Total Horizontal-Surface Down](#) and [Average Daylight Cloud Fraction](#))

Ambassadors and/or their diplomatic staffs from the republics of Guinea, Tanzania, Zimbabwe, Mozambique, and Botswana as well as South Africa asked intensive questions about the NASA SSE data and its availability and requested a DOE contact for further assistance on hardware issues. Address and telephone information for a contact at the DOE National Renewable Energy Laboratory were provided to enable further assistance on their individual project needs.

The DAAC exhibit also outlined efforts in providing NASA science data to help enhance life in rural areas of developing countries that are struggling with poor sanitation, inadequate energy supplies and heavy reliance on human labor. A brochure and other handouts were given to the various dignitaries from several African nations and to United States politicians and business leaders attending the Business Africa Symposium.

## Business Africa Brochure: Introduction

The Earth Observing System (EOS) Data and Information System (EOSDIS) is a comprehensive data and information system developed by NASA under the Earth Science enterprise. EOSDIS manages data from past and current Earth science research satellites, and from field measurement programs; provides processing, data archive and distribution; and provides information management services.

EOSDIS consists of eight Distributed Active Archive Centers (DAACs) and affiliated data centers which archive and distribute data from government and commercial observing missions. The DAACs are the network of data centers whose primary goal is to make information about the Earth's environment available to the scientific and non-scientific communities. IN MOST CASES, THE DATA ARE FREE.

The Langley DAAC was established in 1991 to support the EOS as part of NASA's Earth Science enterprise and the U.S. Global Change Research Program. The DAAC, located at the NASA Langley Research Center in Hampton, Virginia, is responsible for the processing, archival and distribution of NASA's science products in the areas of radiation budget, clouds, aerosols, and tropospheric chemistry. These disciplines include more than 20 projects. In addition, the Langley DAAC has over 250 data sets available, and data from new EOS instruments, scheduled to be launched by the year 2002, will be archived at the Langley DAAC.

Some of the scientific data from the NASA's Earth Science enterprise provide important information to help enhance life in rural areas of developing countries that are struggling with poor sanitation, inadequate energy supplies, and heavy reliance on human labor. According to Dr. Charles Whitlock, a senior NASA scientist, about 40 percent of the people in the world have no electricity. As a result of having no electricity, the drinking water is often contaminated, and must be retrieved by hand from wells or streams. The human time and effort needed to meet the requirements of basic human health, food, and shelter typically leave little opportunity for significant economic and social development. There is very little site data available from ground sites for much of the globe, including large regions of Africa. The NASA satellite data provide the best estimate available of the amount of solar energy at the Earth's surface - energy which could be used in power applications for remote regions.



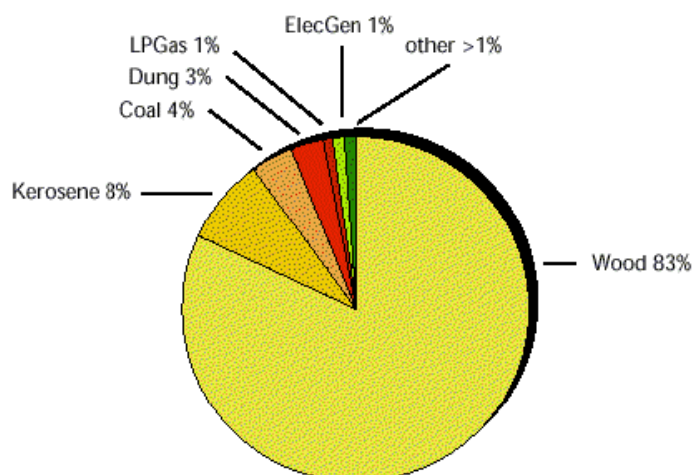
## Business Africa Brochure: Collaborating Agency

### Department of Energy (DOE) National Renewable Energy Laboratory (NREL)

The NASA Langley Research Center and the Department of Energy/National Renewable Energy Laboratory (DOE/NREL) work together under an Interagency Agreement in the application of Surface Solar Energy (SSE) data. The satellite-derived data set, containing 52 monthly averaged parameters, is formulated for the Renewable Energy Industry for the application of solar energy technologies. The SSE data set was created by the NASA Langley Research Center and Analytical Services and Materials, Inc. under the sponsorship of the NASA Earth Science enterprise.

Many people take electricity for granted. Obtaining power is as easy as turning a switch on a wall. For nearly 2 billion people around the globe, however, light, or electric supply is limited to kerosene lanterns, candles, a fire or batteries. DOE/NREL works internationally to help governments and international agencies, such as Renewable Energy for South Africa (REFSA), to develop a comprehensive renewable energy strategy for their countries.

### Estimated 1993 Net rural energy in South Africa



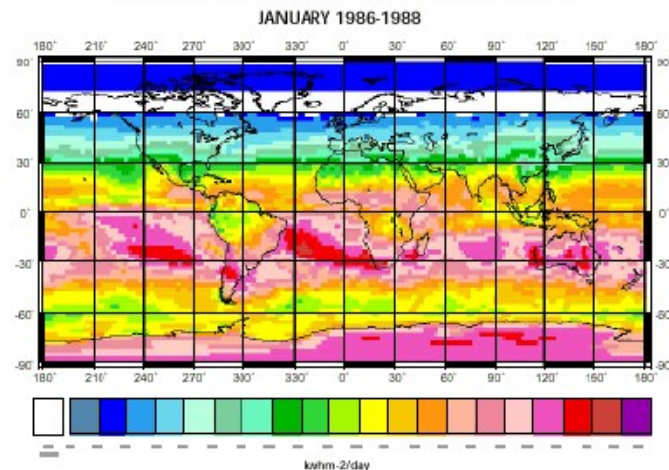
For rural South Africa, overall consumption of fuel from all sources remains low. However, biomass (wood, roots, grass, etc.) continues to be the major source of fuel. Energy is primarily used for cooking and heating, with the tasks of wood gathering consuming many hours per day.

## Business Africa Brochure: Solar Collectors

Renewable energy systems - based on energy sources, such as the Sun, biomass, water, and the wind - are designed to help rural residents overcome the barrier of insufficient power. These systems provide energy for many critical needs - from pumping and heating water to vaccine refrigeration and large-scale agriculture processing. One example of a solar collector is a solar cooker, which is greatly needed in remote regions for food preparation. A solar cooker functions by using a shiny surface to reflect extra sunlight onto black surfaces. The black surfaces change sunlight to heat which is trapped by insulators. Insolation data from the SSE data are used to assess the feasibility of solar cooking at given sites and regions.

NASA's Surface Solar Energy (SSE) data set has already been used successfully by Solar Cookers International (SCI) with the placement of solar cookers in refugee camps. According to Jay Campbell, a director for SCI, "We have found the NASA Surface Solar Energy data set to be a wonderful resource, providing reliable data for any location on Earth. This quality of information is simply unavailable from other sources, and allows us to make better decisions for our consultations and project plans."

### AVERAGE TOTAL HORIZONTAL-SURFACE DOWN



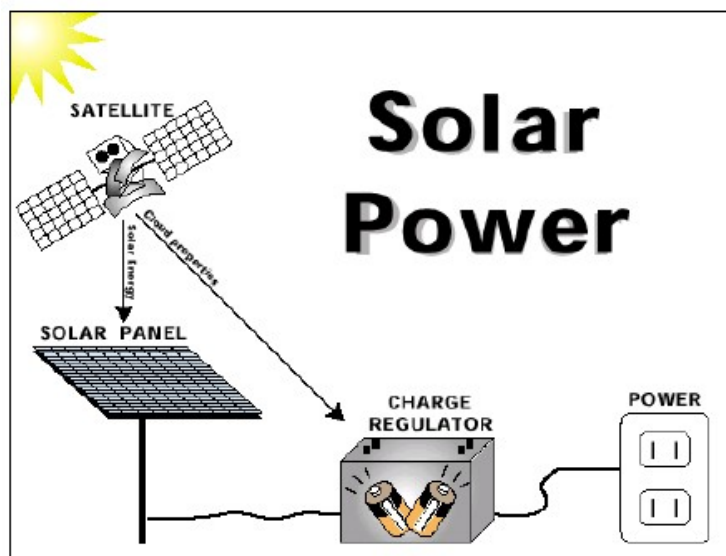
Sample Surface Solar Energy (SSE) data image used to assess the feasibility of solar collectors in remote regions.

## Business Africa Brochure: Photovoltaics

Solar collectors work best in direct sunlight. Photovoltaic (PV) panels, which are used in solar collectors, are the simplest method to generate electricity beyond the reach of power lines. Photovoltaics use semi-conductor solar cells to convert sunlight into direct current (DC) electrical energy. This energy can be used directly or stored in batteries for later use.

PV systems use semiconductor materials that are usually made of silicon and layered between glass or plastic to form a solar cell. When sunlight strikes a solar panel, electricity is produced because the light of the Sun releases electrons. Many solar cells can be combined to produce a large amount of electrical energy.

Photovoltaics (PV) were first used in space in the 1960's to provide power for satellites, but have numerous benefits on Earth, particularly for power needs in remote regions. The PVs have practical application in lighting, water purification, refrigeration, batteries, water pumping and irrigation. The NASA SSE data can be used for locating solar collectors in these applications, and can be used to improve designs of solar-assisted power systems to provide electricity to remote regions of the globe.



## Business Africa Brochure: Related Data

### **SSE** - Surface Solar Energy:

The SSE data set, provided by the NASA Langley Research Center, is a tool enabling precise system designs based on the latest data collected from the NASA Earth Science enterprise. The data are very useful in a wide range of energy technologies and agricultural applications.

### **Research Quality: Data used to calculate SSE data set**

#### **ISCCP** - International Satellite Cloud Climatology Project:

ISCCP focuses on the study of the distribution and variation of cloud radiative properties to improve the understanding and modeling of the effects of clouds on climate. It also analyzes the role of clouds in the radiation balance and to improve our knowledge of the long-term global hydrologic cycle.

#### **CERES** - Cloud and the Earth's Radiant Energy System:

CERES explores the influence of clouds on the Earth's energy budget and the role of clouds in regulating climate. The CERES instruments should produce unprecedented accuracy in the measuring of the Earth's radiation budget.

#### **ERBE** - Earth Radiation Budget Experiment:

The objective of ERBE is to provide measurements related to the Earth's radiation budget (global albedo, fluxes, and solar incidences).

#### **SRB** - Surface Radiation Budget:

The goal of the SRB project is to produce a long-term global data set of various components of the surface radiation budget using ISCCP-C1 and ERBE data.



These data are available from the NASA Langley DAAC web site at:

<http://eosweb.larc.nasa.gov>

or by contacting the

[Langley ASDC User and Data Services Office.](#)

